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The Nexus Between Real Estate Industry and Economy Growth: Case study of Shanghai

Ruipeng Ma [1,*]

[1] Faculty of Business and Economics, University of Malaya, Kuala Lumpur, Malaysia.
* Correspondence: Ruipeng Ma, Faculty of Business and Economics, University of Malaya, Kuala Lumpur, Malaysia.

Abstract: In the 1970s, the theory circle of China put forward the idea of housing commercialization for the first time. After the 1990s, the housing monetization policy began to be implemented. After China opened the door of reform and opening up and the door of urbanization process, the real estate industry also continuously seized the opportunity brought by the reform and opening up to make its own growth. In addition, the real estate industry not only promotes the growth of national economy, but also plays an significant role in improving residents' living quality and seeking benefits for residents. So far, the real estate industry has become the bellwether and main force of China's economic development. The outbreak of the global financial crisis in 2008, followed by 2013, China began to advocate the "new normal" trend of economic development, explore new ways of economic growth and improve the structure of economic growth, which hindered the development of the real estate industry to varying degrees. However, under the macro-background of a series of policies and controls, the real estate industry still plays an immeasurable role in China's economic growth. Therefore, this chapter attempts to carry on a further elaboration in the current macroeconomic background, to clarify the purpose and significance of the research。 In this context, this paper will analyze the relevant data of Shanghai real estate from 1991 to 2021 as the basis. Through the process of data analysis to explain the real estate industry to Shanghai's economic contribution. It also determines whether the relationship between Shanghai real estate industry and economic growth is negative or positive and fills the literature gap between Shanghai real estate industry and economic growth. Provide strong support for future research or policy decision.

Keywords: housing commercialization, real estate industry, economic growth

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1. Introduction

The development of the real estate industry itself has also led to the development of many other industries, such as manufacturing, construction and decoration. While bringing huge economic effects and jobs, problems also come one after another. The biggest problem is over-reliance on the real estate sector to grow the economy, leading to the expansion of the real estate bubble. And because of the huge profits brought by the real estate industry, it affects the development of other industries. Excessive dependence will inevitably lead to economic collapse, so China is now trying to reduce its dependence on the real estate industry. To combat malicious hoarding and price hikes, the policy stipulates that individuals will be charged additional taxes on their second homes. It also requires additional social security contributions.

The main objective of this study is to investigate the impact of real estate industry on economic growth in Shanghai. Most important is to evaluate whether it exist positive relationships of real estate industry on economic growth. And the analysis was based on data from 1991 to 2021 in Shanghai City.

In 2004, the real estate industry was defined as the pillar industry of economic growth in China, it means that the contribution of real estate industry to economic growth in China is huge. However, the previous paper mainly focused on the impact of the real estate industry in economic growth at the national level or by taking multiple regions as research objects, and there is no single article was found about the impact of Shanghai's real estate industry on economic growth. As the economic center and financial center of China, Shanghai takes very important place in China, according to the Figure 1 below we can see that Shanghai ranks first as a city in terms of GDP contribution, which is 4.3214 trillion in year 2021.

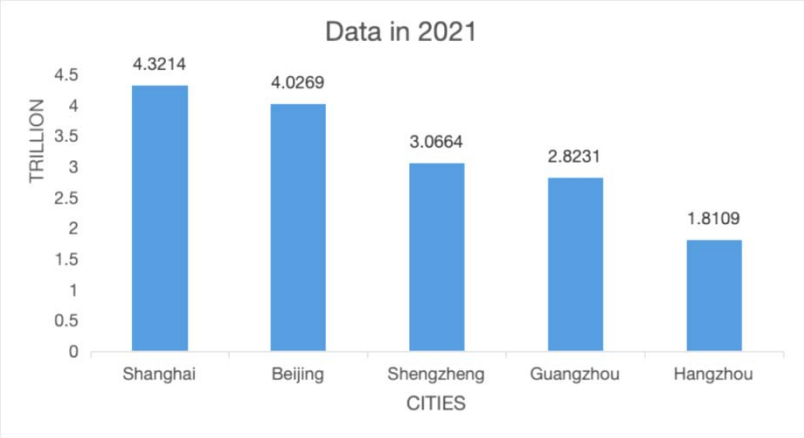

Figure 1. Data in 2021.

2. Methodology and Model

The study will only choose few simple but important indicators to test the relationship between those variables and GDP. And remove some of the complex theory appeared in previous studies, for example Industrial relevance theory, to make this article more easy to understand and suitable for undergraduate research level.

There are many kinds of academic research method. First through the literature review part, we can accumulate related research background and theoretical basis, and then use the several related data of Shanghai real estate industry and GDP, to evaluated with quantitative and qualitative analysis. Moreover, using the method of empirical analysis, deeply analyze and explore the impact of the real estate industry on GDP.

This study analyzes the data of Shanghai from 1991 to 2021. Because In 2003, the National Bureau of Statistics announced that China would improve the GDP calculation and data release system, eliminate misleading estimates, establish a mechanism for regularly revising and adjusting GDP data, release relevant important data and publish accounting methods when necessary. The revised GDP calculation method is in line with international standards and more accurate and convincing.

First of all, we use following related data to do the quantitative research and conclude the obvious changes in the data:

1) Gross domestic product of Shanghai.
2) Real estate housing development investment amount in Shanghai
3) Sales of residential building in Shanghai
4) Sales of commercial housing

After finish the quantitative research on the data, we choose those main data as our independent variables in following content. Moreover, the hypothesis of this paper also can be determined, and the empirical analysis will be carried out in the Chapter four.

2.1. Model Specification

$$GDP_t = f(REHDIA_t, SRB_t, SCH_t) \quad (1)$$

$$GDP = \beta_0 + \beta_1 REHDIA_t + \beta_2 SRB_t + \beta_3 SCH_t + e_t \quad (2)$$

GDP=Gross domestic product in Shanghai
REHDIA= Real estate housing development investment amount
SRB= Sales of residential building
SCH= Sales of commercial housing
E_t= error term

2.2. ARDL Model

"ARDL" model stands for "Auto-regressive-Distributed Lag". This type of regression model has been used for decades, but it has recently been demonstrated that it provides a very valuable vehicle for investigating the presence of long-run correlations between economic time-series. According to Chung Yan Sam et al., one advantage of this improved ARDL limits test is that the assumption of an I(1) dependent variable is not required (2019).

$$\Delta GDP_{2t} = \beta_0 + \beta_1 GDP_{2t-1} + \beta_2 REHDIA_{t-1} + \beta_3 SRB_{t-1} + \beta_4 SCH_{t-1} \quad (3)$$

$$\Sigma\lambda_1 \Delta GDP_{2t-I} + \Sigma\lambda_2 \Delta REHDIA_{t-I} + \Sigma\lambda_3 \Delta SRB_{t-I} + \Sigma\lambda_4 \Delta SCH_{t-I} + e_{t-1} \quad (4)$$

2.3. Hypothesis Development

The hypothesis of this study is that the real estate industry will have a positive impact on economic growth. In other words, the real estate industry will boost economic growth. GDP is selected as the dependent variable and several important data related to the real estate industry are selected as independent variables. In addition to proving the hypothesis of this paper, the paper will also test the separate influence of several independent variables on the dependent variable.

The hypothesis of this article is same with the previous study viewpoint No.1, which is The real estate industry will have positive impact on GDP. After the hypothesis of this paper is assumed, the hypothesis will be tested. And to test the relationship between the each independent variables and dependent variables.

However, in this paper we only choose three related data of real estate industry as independent variables, which are Real estate housing development investment amount in Shanghai (REHDIA) , Sales of residential building in Shanghai (SRB), Sales of commercial housing in Shanghai (SCH), and select GDP of Shanghai as our dependent variables. In the end, to test the influence of three independent variables on the dependent variables and the influence of dependent variables on independent variables. So there will be three hypothesis :

H_θ: REHDIA has positive relationship on GDP
Ha: REHDIA has negative relationship on GDP
H_θ: SRB has positive relationship on GDP
Ha: SRB has negative relationship on GDP
Hθ: SCH has positive relationship on GDP
Ha: SCH has negative relationship on GDP

After examining the data of the independent and dependent variables, we can understand the relationship between the dependent variable and independent variables. And determine if the three assumptions in the article exist or not.

3. Data and Variables

We can observe from the Figure 2 that the Real estate housing development investment amount in Shanghai has been increasing obviously since 1993. Although the real

estate industry suffered from financial crisis and national macro policy adjustment during 1991 to 2021, and the negative growth appeared. But overall REHDIA has been growing and increasing year by year.

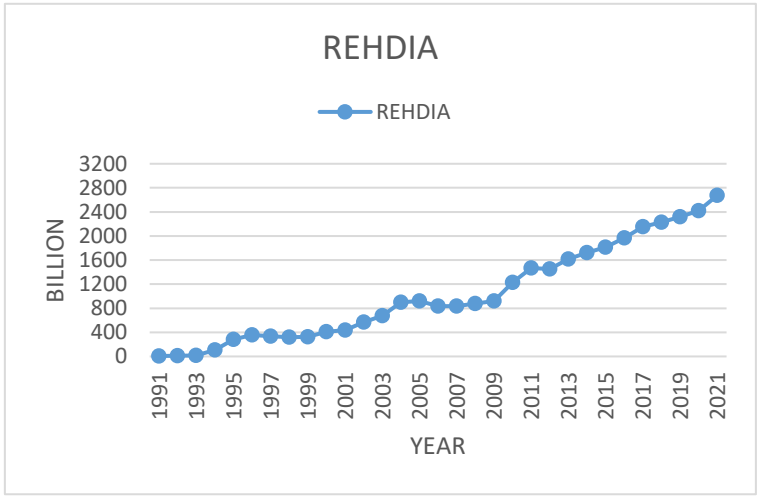

Figure 2. Investment amount in Real estate housing development of Shanghai during 1991-2021.

As can be seen from Figure 3 above, Sales residential building in Shanghai have been rising since 1991. Although there were several big fluctuations and negative growth between 2003 and 2021, the SRB of Shanghai was still in a state of growth on the whole.

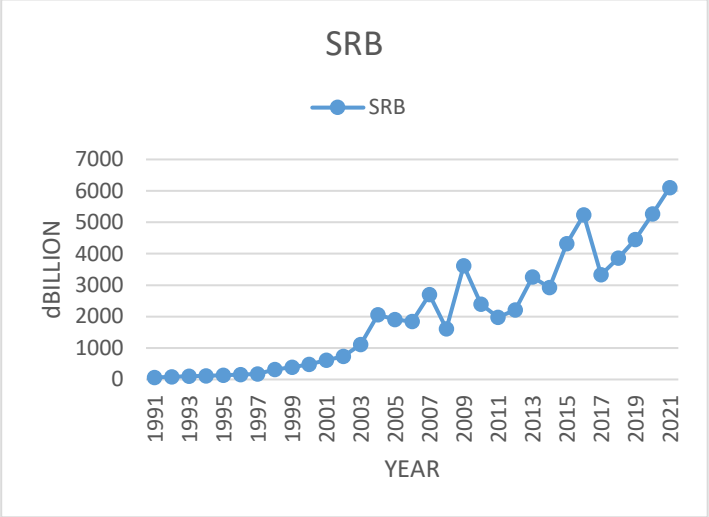

Figure 3. The sales of residential building of Shanghai during 1991-2021.

From Figure 4 we can see that the first negative growth occurred in 2008, when the global financial crisis came. The impact of the financial crisis on the real estate industry is not limited to Shanghai. All regions in China have been hit to some extent.

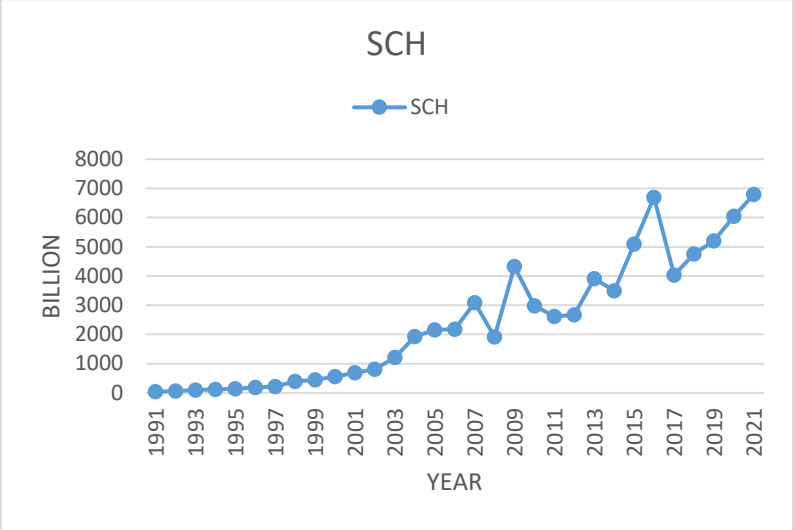

Figure 4. The related data of sales commercial housing during 1991-2021.

In 2009, the government issued 14 macro-control policies to stimulate real estate consumption and revive the market affected by the financial crisis:

1) For individuals purchasing ordinary houses of 90 square metres or less for the first time, the deed tax rate will be temporarily reduced to 1%. The local Real Estate Exchange Center issues the certificate of first acquisition.
2) Temporary exemption from stamp duty on individual dwelling transactions or acquisitions.
3) Individual housing transactions will be temporarily free from the land value added tax.
4) To give loans to residents for the initial purchase of ordinary and enhanced ordinary self-owned residences, the loan interest rate can be extended to 0.7 times the benchmark lending rate, with a minimum down payment ratio of 20%.
5) Interest rates on individual housing provident fund loans will be lowered by 0.27 percentage points.
6) Individuals who purchase ordinary housing for more than two years and sell it abroad shall not bear business tax.
7) Individuals shall not bear individual income tax on the income derived from the transfer of a house used by themselves for more than two years and used for the sole purpose of family life.
8) The minimum down payment ratio of housing provident fund loans will be adjusted to 20% for those who buy ordinary houses for their own use. For families buying ordinary houses for self-use for the first time, if they meet the loan conditions, the maximum amount of basic provident fund can be borrowed from 200,000 yuan to 300,000 yuan per borrower, and the maximum loan limit for each family is 600,000 yuan. If there is a supplementary housing accumulation fund, the maximum loan limit for each family is 800 thousand yuan.
9) Housing registration fees for individuals purchasing ordinary housing and housing transaction (transfer) fees for individuals buying and selling ordinary housing stock are exempted.
10) Adjust the standard of ordinary housing in the city.
11) Continue to intensify efforts to renovate old areas in central urban areas.
12) Establish and strengthen a housing security system, boost the supply of low-rent housing through acquisition and other ways, raise physical housing allocation, and broaden the scope of low-rent housing subsidies.
13) Establish a real estate market information release system, standardise market operations of real estate development and intermediary enterprises, strengthen

real estate market management, implement supervision over transaction funds of existing houses, and effectively protect buyers' legitimate rights and interests.

14) Strictly implement the general plan for land use and the annual plan for land use, strengthen land supply management, and tighten land supply for commercial housing projects.

The above policies well explained why most variables (including SCH) experienced a huge increase in 2009.

4. Analysis and Discussion

4.1. Introduction

This chapter mainly display the testing process of each variables. Start from Unit root test, Bound test for co-integration, long-run relationship test, short run relationship test, Heteroskedasticity test, Serial Correlation LM Test, Cusum test and Cusum Square test. First of all, we need to make sure that all the variables will be stationary in First difference level by running Unit root test. When the variables is confirmed stationary, we can do other tests one by one.

4.2. Unit Root Test

Table 1 shows the result of unit root test by using method of Augmented-Dickey-Fuller (ADF) and Phillips-Perros test (PP). After completing the unit root test, it is found that all the variables are non-stationary which indicates that all data in the model are stable and can be used in following work.

At level, the ADF test failed to reject the null hypothesis of non-stationary of GDP, REHDIA and SRB, but successfully rejected the Null hypothesis of non-stationary of SCH. And the result is at the 1% significance level. The result of PP test at Level same with ADF Test, the null hypothesis of non-stationary of most variables (GDP, REHDIA and SRB) was failed to be rejected, only SCH was successfully rejected.

At first difference level, the ADF test strongly rejected most variables at 1% significance level except GDP. The PP test at First difference level has also successfully rejected all variables at 1% significant level. The result can allow us to use the above data to go through the ARDL model and following steps under the condition that variables are co-integrated of first order. This result of Unit root test is same with the

Table 1. Result of unit root test.

Variable	ADF		PP	
	No Trend	Trend	No Trend	Trend
		Level		
GDP	10.06(0)	-0.349(7)	9.884(6)	1.390(5)
REHDIA	1.945(0)	-1.031(0)	4.709(12)	-0.478(6)
SRB	0.385(1)	-3.919(0)	0.711(4)	-3.797(3)
SCH	0.163(1)	-4.394(0)*	0.327(4)	-4.324(3)*
		First Difference		
GDP	0.1838(6)	-2.098(6)	-2.812(4)	-5.751(2)*
REHDIA	-3.714(0)*	-4.146(1)*	-3.595(3)*	-4.292(10)*
SRB	-7.769(0)*	-7.904(0)*	-9.685(8)*	-14.19(13)*
SCH	-8.263(0)*	-8.313(0)*	-11.81(12)*	-23.82(23)*

Notes: The number in ( ) show the lag length used for ADF test is based on Schwarz Info Criterion (SIC) while the lag length used for PP test is based on Newey-West Bandwidth. The (*) represents the 1% significance level.

Note: Figures in parenthesis ( ) represents the lag length used in Eviews. ADF test is based on SIC, PP test is based on NWB. The * represents the 1% significance level.

4.3. Bound Testing for Co-Integration

The result of ARDL model can be seen from Table 2 below. According to the F-statistic and critical value result, the null hypothesis of none co-integration is refused at 1% significance level. It means that there is co-integration relationship among the GDP of Shanghai, REHDIA (Real estate housing development investment amount), SRB(Sales of residential building) and SCH(Sales of commercial housing). However, the result shows that there is a long-run relationship between dependent variable and independent variables. But tests are needed to confirm which of these independent variables is related to GDP.

Table 2. Result of ARDL bound test.

F-statistic	Critical Value		Significance level
	I(0)	I(1)	
10.876193	3.00	4.15	10%
	3.71	5.01	5%
	5.33	7.06	1%

Notes: Critical values are determined by using Pesaran et al. (2001) and Narayan (2005). The structural lags used in this regression is extracted by applying minimum Akaike's Information Criterion (AIC).

4.4. Long-Run Relationship Test

Table 3 below shows the long run relationship of three independent variables and dependent variable. From the table we can observe that the each P value of REHDIA, SRB and SCH are **0.0311, 0.4555 and 0.6301**. The value of SRB and SCH are bigger than 5% significance level and 10% significance level, Which means that there is no long-run relationship or the effect is weak between these two independent variables and dependent variable-GDP.

But from the P-value of REHDIA we can see that the P value is below 0.05(5% significance level). That means there is a long-run relationship between REHDIA and GDP. And if REHDIA(Real estate housing development investment amount) increase at a rate of 1%, the GDP(Gross domestic product of Shanghai) will increase by 4.7913 trillion RMB. Moreover, the long-run relationship test also rejects the hypothesis of SRB and SCH in this paper, and the results prove that the contribution of SRB and SCH to GDP of Shanghai is not obvious. But the contribution of REHDIA to the GDP of Shanghai is clear.

Table 3: Result of long-run relationship.

Variable	Coefficient	t-statistic	Prob.
REHDIA	4.7913	2.3282	0.0311
SRB	-0.8452	-0.7617	0.4555
SCH	0.4319	0.4894	0.6301

4.5. Short-Run Test

Table 4 below is showing the test result of short run relationship. According to the ECM(CointEq(-1)), is negative and statistically significant at 1% level. It means that there is a co-integration in the model. Therefor, the P-value of SCH and SRB still bigger than 0.05(5% significance level), which means there is no short run relationship. But the P-value of REHDIA indicates that short run relationship exist.

Table 4. Short-run dynamic test.

Variable	Coefficient	t-Statistic	Prob.
Constant	21.711	0.091	0.928
$\Delta REHDIA_t$	4.791	3.064	0.006
$\Delta REHDIA_t(-1)$	-4.404	-2.394	0.027
ΔSCH_t	0.431	0.654	0.520

$\Delta SCH_t(-1)$	-0.781	-4.165	0.000
ΔSRB_t	-0.845	-1.044	0.309
CointEq(-1)	-0.149	7.097	0.000

Notes: Δ denotes the change in the variables. ECM stands for Error Correction Model.

4.6. Heteroskedasticity Test

Table 5 below is showing the result of heteroskedasticity test by using the Breusch Pagan Godfrey method. From this test we can see that all the variables are constant or not. According to the Chi-Square value, 0.114 is bigger than 0.05(5% significance level). Thus, there is no heteroscedasticity in the model.

Table 5. Breusch-Pagan-Godfrey test.

F-statistic	**5.255**	**Prob. F(9,19)**	**0.001**
Obs*R-squared	20.68	Prob. Chi-Square(15)	0.014
Scaled explained SS	14.236	Prob. Chi-Square(15)	0.114

4.7. Serial Correlation LM Test

After set up the lag-2, and the Chi-Square value is obtained. We can found that there is a serial correlation relationship since 0.021 is small than 0.05(5% significance level) in Table 6.

Table 6. Breusch-Godfrey Serial Correlation LM test.

F-statistic	**3.044**	**Prob. F(2,17)**	**0.074**
Obs*R-squared	7.647	Prob. Chi-Square(2)	0.021

4.8. Cusum and Cusum Square Test

The purpose of Cusum and Cusum square test is to test the stability of the model. The result of future outcome maybe will be affected if the model is not stable. And Figures 5 below shows the stability of model using in this paper. From the Cusum test we can see that the blue line always moving in the red line, which represent 5% significance. But from figure of CUSUM Square test can observe that the blue line is below 5% significance level line from 2008 to 2020, became normal after 2020. However, the result was still acceptable, though only one test was passed.

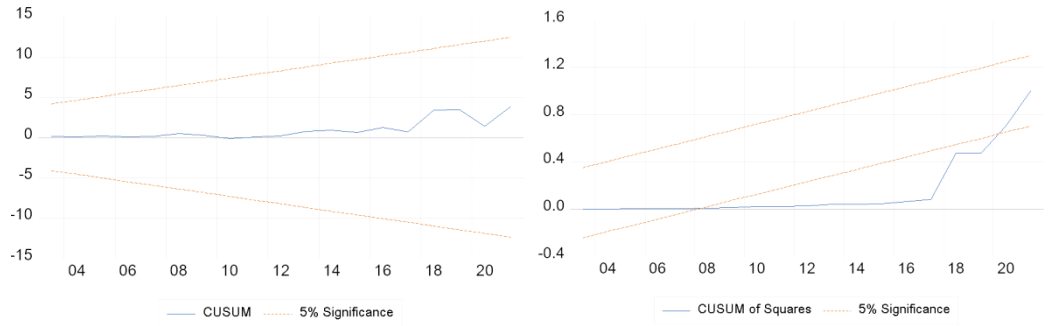

Figure 5. The stability of model.

5. Conclusion

Firstly, the ADF and PP unit root test methods were used to check whether all the variables data were stable or not. The results of ADF and PP test indicate that all variables pass the unit root test at Level 1 (I1). It means all the variables are stationary. Then the relationship between dependent variable and independent variables is tested by ARDL model. First, F-value of Bound test (9.896) indicates that there is some relationship between dependent and independent variables, and it is at 1% significance level. Then,

through the Long-run relationship test, we draw the conclusion that there is a Long-run relationship between the variable REHDIA and GDP. Since the P-value of SRB and SCH is greater than 5% significance level(0.05), it can be concluded that there is no Long-run relationship among SRB and SCH to dependent variable-GDP. After experimenting with Long-run relationship, still need to do the short-run dynamic test. The p-values among the three independent variables are respectively 0.000(REHDIA), 0.580(SCH) and 0.046(SRB). The p-value of REHDIA and SRB passed the short-run dynamic test, and both were less than 0.05(5% significance level). In the short-run dynamic test, only SCH fails, which proves that there is no short-run relationship between SCH and GDP. After that, Heteroskedasticity test is completed, and it can be seen from the test result that all variables are constant. Then the serial correlation LM test has been completed, the result showing that there is no auto-correlation and serially correlated in this model. Finally, CUSUM and CUSUM SQUARE tests were conducted. The purpose of these two tests was to testify whether the ARDL model was stable in the long run and has reference value. From the CUSUM test, you can see that the blue line always moves within the red line of 5% significance. The result of the CUSUM SQUARE TEST crossed the red line of 5% significance between 2015 and 2017, indicating that the model was unstable. However, since one of the two tests passed the CUSUM TEST, the conclusion still can be made that the ARDL model is long stable. And the result is acceptable.

However, through the chapter-4, the relevant data from 1991 to 2021 of the real estate industry in Shanghai and Shanghai's GDP are tested, and it is found that the contribution of the real estate industry to the economic growth in Shanghai plays major role. As can be seen from Long-run relationship test, If REHDIA grows at a rate of 1%, its contribution to Shanghai's GDP will be 4.79 Trillion RMB. As the financial center of China and its special geographical location, Shanghai does not need to over-rely on the real estate industry to develop its economy.

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